16, 20 are centered on the photo-receivers of the receiving units 6, 4, respectively. The alignment of the light beam can be detected as a function of received optical power, signal intensity, and the like and this detected alignment information can then be fed back to the transmitter. Also described in greater detail in co-pending patent application 09/620,943 is a preferred embodiment mechanism for controllably steering the light beam. In addition to transmitting data to or from data from data source / sink 8, OWL 6 transmits the light beam alignment feedback signals to OWL 4 over light beam 20. Likewise, OWL 4 transmits beam alignment feedback signals to OWL 6 over its light beam 16, in addition to data to or from data source / sink 2. Because light beams 16, 20 are high bandwidth, low latency paths, the transmission of feedback signals over the beams allows for rapid alignment of the beams (low latency) without degrading the data handling capabilities of the system (high bandwidth). In the preferred embodiments, OWL devices 4 and 6 communicate with each other using standard 100 Mb/s Ethernet protocol. The inventive concepts described herein apply equally to other communication protocols, including ATM, TCP/IP, SONET, IEEE 1394, IRDA, 10 Mb/s Ethernet, Gigabit Ethernet, and other alternatives within the purview of one skilled in the art. --

A2

Please replace the paragraph beginning at page 11, line 17, with the following rewritten paragraph:

-- Details regarding the apparatus and method for communicating alignment control signals between OWLs 4 and 6 are provided in co-pending, commonly assigned patent application 09/923,510, filed August 6, 2001, and entitled "System and Method for Embedding Control Information within an Optical Wireless Link" and incorporated herein by reference. Details regarding a method for allowing the OWLs 4 and 6 to automatically, efficiently and quickly align themselves to one another will be provided herein. –

A3

Please replace the following paragraph beginning at page 16, line 19, with the following rewritten paragraph:

A4

-- At this point, the two devices will be nominally aligned because each OWL will have its beam positioned at a point where the receiving device had been able to receive it. Having

established communication in this way, the OWL devices will then transition into an operational mode where data between data source / sinks 2 and 8 can begin. Periodically, both OWL 4 and OWL 6 will re-transmit a control packet to ensure the devices remain in alignment as described in detail in co-pending patent application 09/923,510 entitled "System and Method for Embedding Control Information within an Optical Wireless Link." –

Please replace the paragraph beginning at page 17, line 1, with the following rewritten paragraph:

-- The above described method of aligning two devices can be thought of "echoing" alignment information back to its source. Initially, the first optical device has no alignment intelligence and simply transmits its beam position information out blindly, updating the position information as the beam sweeps through the acquisition pattern. Eventually, the beam will impinge upon a second optical device, which will receive the beam position information for the first device. This second device will then begin echoing back the position information for the first device (as well as its own periodically updated position information) as the second beam is swept through its acquisition pattern. When the second beam impinges upon the photodetector of the first device, the first device then receives its own position information echoed back to it. Because the position information has been echoed back to it, the device knows that it was nominally aligned at that position. Likewise, the first device will echo back to the second device the beam position information it received from the second device. –

Please replace the paragraph beginning at page 22, line 19, with the following rewritten paragraph:

-- In the preferred embodiments, the circles will overlap each other by approximately fifty percent in order to increase the likelihood of impinging upon the target photodetector while a control packet is being transmitted (control packets are transmitted at approximately 4 kHz, or once every 250 μs), as shown in Figure 7. Each beam pattern 300, 302 is one mrad wide (i.e. the beam size). The first circle 300 is swept followed by a second circle 302 that is offset from the first circle 300 by only 0.5 mrad. Note that the beam is modulated with the control packet

information at points 304 and 306 and that the beam is moving during the transmission period. The beam might not be aligned with the photodetector during the period 304 of the first sweep, but may be aligned during the period 306 during the second overlapping sweep. Because of this overlap, one full spiral scan takes 170 circles, resulting in approximately 8.5 seconds per scan. –

Please replace the paragraph beginning at page 24, line 24, with the following rewritten paragraph:

-- In the presently preferred embodiments, the light beam position information can only be updated approximately once every 250 μs or at 4 kHz. This is because of the time required to physically measure and calculate the position of the light beam steering device, such as a micro-mirror (as described in detail in co-pending applications 60/234,081 and 60/233,851. Hence, the control packet "My X" and "My Y" information is updated only once every 250 μs. Note, however, that the control packet is preferably only 5 μs long when transmitted over the 100 Mb/s Ethernet protocol optical wireless channel (64 bytes X 8 bits/byte X 100 Mb/s = 5 μs). Ethernet protocol requires a minimum spacing between each frame (or packet) on the order of 1 or 2 μs. Hence, it is possible under the protocol to transmit a control packet over the modulated light beam every 6 or 7 μs. As stated above, however, the position information is updated approximately only every 250 μs. Nonetheless, in another preferred embodiment approach, the control packets are "over-sampled," i.e. sent out at a higher rate than the 4 kHz rate at which the position information is updated. This is illustrated schematically in Figure 7. As shown, in the above described embodiment, a first control packet is sent at the point in time when the sweep pattern is at the point indicated by point 308. 250 μs later, a next data packet containing updated position data is sent, at the point indicated by 310. In the alternative embodiment with over-sampling, additional control packets, indicated by points 312, 314, 316, and 317 are transmitted. Note that these packets are sent every 50 μs. As such, the control packets 312 through 318 do not contain updated beam position information. Not until the position indicated at 310 (250 μs later) is the beam position information updated. Note that the beam position information is therefore not entirely accurate for those intermediate control

packets 312 through 317. In other words, the beam position information ("My X" and "My Y") being transmitted at point 308 is accurate for point 308, but that same information is then sent again at points 312 through 317, even though the beam has moved along its sweep pattern. Not until point 310 is the beam information updated to the x and y coordinates for point 310. Again the x and y coordinate information for point 310 is re-sent at points 318, 320, 322, and 324. At point 326, the x and y information is once again updated to the new position. The rationale behind over-sampling in this manner is that the chances of aligning the light beam with the remote photodetector at a time the light beam is transmitting the control packet is significantly increased by sending the control packet five times as often (as indicated by the difference in the spacing between points 308 and 310 versus the difference in the spacing between points 308 and 312). Therefore, even though the x and y coordinate position information is not entirely accurate for four out of the five times the control packet is transmitted, the information is accurate enough for a first pass alignment. The inherent inaccuracy is not as significant as the increased benefit derived from over-sampling. While the preferred embodiment is described in terms of five times over-sampling, one skilled in the art will recognize that an even greater over-sampling rate will further increase the likelihood of transmitting a control packet when the beam impinges upon the remote photodetector. The practical limit to the over-sampling rate would depend upon the length of the control packet, the need for inter-frame spacing, and the sweep speed of the beam itself. On the other hand, a lesser over-sampling rate (such as two times) would not provide as great a benefit, but would nonetheless increase the chances of transmitting a control packet at the right time. –

Please replace the paragraph beginning at page 26, line 22, with the following rewritten paragraph:

-- One embodiment of an optical module 30 is provided in Figure 8. The module includes an Encoder/Decoder Unit 320, coupled by a two-way Data Link 322 to an Optical Transceiver Unit (OTU) 324. The OTU 324 acts as an electrical to light and light to electrical converter. It contains a light source, such as a laser or light emitting diode, control electronics

for the light source, a photo-detector for converting the received light to electrical signals and amplifiers to boost the electrical strength to that compatible with the decoder. –

Please replace the paragraph beginning at page 27, line 3, with the following rewritten paragraph:

-- The OTU 324 can also be of conventional design. For example, a TTC-2C13 available from TrueLight Corporation of Taiwan, R.O.C., provides an advantageous and low cost optical transceiver unit, requiring only a single +5V power supply, consuming low power, and providing high bandwidth. However, it should be noted that OTU units of conventional design can provide less than optimal performance, since such units are typically designed for transmitting and receiving light from fibers. This results in three problems that should be noted by the designer. First, light is contained in such units and is thus not subject to the same eye safety considerations as open air optical systems such as the present invention. Consequently, such units may have excessively high power. Second, light is transmitted to a fiber and thus has optical requirements that are different from those where collimation is required, as in embodiments of the present invention. Third, light is received by such units from a narrow fiber, and therefore such units usually have smaller detector areas than desired for embodiments of the present invention. Accordingly, it is considered preferable to assemble a transceiver having a photodiode and optical design such that the maximum amount of light is collected from a given field of view. This requires as large a photodiode as possible, with the upper limit being influenced by factors such as photodiode speed and cost. In any event, a preferred light source is a vertical cavity surface emitting laser, sometimes referred to as a VCSEL laser diode. Such laser diodes have, advantageously, a substantially circular cross-section emission beam, a narrow emission cone and less dependence on temperature. –

Please replace the paragraph beginning at page 28, line 23, with the following rewritten paragraph:

-- For optical wireless links across large distances where the highest possible optical power density at the receiver is needed for robust transmission, the optical portion of the

preferred embodiments should preferably be selected to achieve a divergence of less than 0.5 mrad, which is to be contrasted with the prior art systems that have divergences in the range of 2.5 mrad. The divergence of less than 0.5 mrad results in an optical density greater than 25 times the optical density of the prior art systems, which, for the same received optical power density corresponds to 5 or more times longer range. –

A10

Paragraph beginning at line 11 of page 29 has been amended as follows:

-- It should also be understood that more than one Optical Transceiver Unit 324 may be provided in some embodiments, for example to provide multiple wavelengths to transmit information across a single link, in order to increase the bandwidth of a given OWL link. This involves generating light beams having multiple wavelengths and collecting and separating these separate light beams. Numerous apparatus and methods are taught in co-pending patent application 09/836,690, filed April 20, 2001 and incorporated herein by reference. --

A11

In the Abstract:

Please replace the paragraph beginning at page 38, line 2 with the following rewritten paragraph:

-- Optical wireless links automatically align themselves using feedback information that is transmitted over the light beams being aligned. Each link performs an acquisition routine in which its light beam is swept through a pre-defined pattern while transmitting its beam alignment information. When a link receives beam alignment information from a remote link, it updates its transmission to include the alignment information received from the remote link. At some point during the acquisition routine, the remote link will receive its own alignment information "echoed back" from the first link and will re-align its beam accordingly. At some point, each link will have received its own alignment information echoed back from the other link and will have aligned itself to that position. Data communication can begin at that point, or

A12

A12

a more refined alignment step can then be performed. The alignment information can be based upon position, sample number, or time transmitted. --